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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Jack O. Chu, et al. **Examiner:** Johannes P. MONDT
Serial No: 10/775,514 **Art Unit:** 2826
Filed: February 10, 2004 **Docket:** YOR920010308US3 (16315B)
For: EPITAXIAL AND POLYCRYSTALLINE GROWTH OF $\text{Si}_{1-x-y}\text{Ge}_x\text{C}_y$ AND $\text{Si}_{1-y}\text{C}_y$ ALLOY LAYERS ON Si BY UHV-CVD **Dated:** January 31, 2006

Confirmation Number: 1038

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Commissioner for Patents
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**DECLARATION UNDER 37 C.F.R. §1.132 OF DR. JACK OON CHU
IN U.S. PATENT APPLICATION NO. 10/775,514**

Sir:

I, **Dr. Jack Oon Chu**, hereby declare that:

(1) I am one of the inventors and applicants for U.S. Patent Application No. 10/775,514, filed on February 10, 2004 in the U.S. Patent and Trademark Office in the names of Jack Oon Chu et al. for "EPITAXIAL AND POLYCRYSTALLINE GROWTH OF $\text{Si}_{1-x-y}\text{Ge}_x\text{C}_y$ AND $\text{Si}_{1-y}\text{C}_y$ ALLOY LAYERS ON Si BY UHV-CVD," which is referred to hereinafter as "the Application."

(2) The Application describes and claims layered structures that each comprise an interface defined by adjacent single crystalline layers and have an abrupt change in C concentration of

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more than 1×10^{18} atoms/cc over a layer thickness in the range from about 6 Å to about 60 Å. Specifically, such an interface is defined between an upper surface of a single crystalline Si layer and one or more single crystalline material layers, which include at least one layer of single crystalline SiC or single crystalline SiGeC, and more preferably include a single crystalline SiC layer.

(3) Such layered structures, as described in paragraph (2) hereinabove, have been fabricated using an ultra high vacuum chemical vapor deposition (UHV-CVD) process, which was conducted, for example, at a growth temperature of about 500°C to deposit single crystal SiC or SiGe layers over single crystal Si substrates. The approximate deposition rate observed was from about one (1) monolayer to about ten (10) monolayers of SiC or SiGe per minute. Each monolayer of SiC or SiGe had a thickness of about 6Å.

(4) Carbon concentration changes were immediately effectuated in the deposited single crystal SiC or SiGe layers by changing the flow rate of the carbon precursor into the deposition chamber.

(5) A transmission electron microscopy (TEM) photograph taken at a magnification scale of about 40,000X was included in Figure 2 of the Application to show some of the SiC layers formed by the UHV-CVD process, as described by paragraphs (3) and (4) hereinabove. The TEM photograph of Figure 2 indicates the approximate positions of the layer interfaces between the SiC and SiGe layers, but it cannot show the abruptness of the carbon concentration changes at the layer interfaces.

(6) Based on the deposition rate and the change in the carbon precursor flow rate, it was inferred that the SiC/SiGe interface layers shown in the TEM photograph of Figure 2 represented very abrupt carbon concentration changes (i.e., more than 1×10^{18} atoms/cc) that had occurred within 1-10 monolayers of SiC or SiGe, which corresponds to a layer thickness in the range from about 6Å to about 60Å.

(7) Secondary ion mass spectrometry (SIMS) results for the layered structure shown in the TEM photograph of Figure 2 were obtained and included in Figure 1 of the Application. Unfortunately, SIMS results had very limited depth resolution (about 125 Å/decade at the time of its analysis). Therefore, the SIMS results shown in Figure 1 of the Applicant only illustrate the amount of overall carbon concentration changes occurred between different structural layers, but they cannot show the abruptness of such changes at the layer interfaces, due to the limited depth resolution of the SIMS results.

(8) I hereby declare that all statements made herein, of my own knowledge, are true, that all statements made on information and belief are believed to be true, and that these statements are made with the knowledge that willful false statements and the like so made may be punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the U.S. Code and that such willful false statements may jeopardize the validity of the application or any patent issued therefrom.


Jack Oon Chu

1-31-06
Date